MESOSPHERIC CIRCULATION AND NOCTILUCENT CLOUDS IN THE SPRING OF 1967

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ABSTRACT. From the comparison of noctilucent cloud data (abbreviation: LN) and spring transition of wind of the mesosphere during the year 1967 it follows that the period in which noctilucent clouds were seen continuously only began after the spring transition of wind was complete. Furthermore it is shown that the characteristics of summer circulation will appear first at low altitudes of the atmosphere and ascend to the mesosphere later.

1. Introduction

At present there is no generally accepted explanation for the appearance /489* of the noctilucent clouds (LN). The reason for this is first the lack of observed data and secondly there is insufficient knowledge of the physics of the mesosphere, the zone, that is, where the LN appear.

From the fact that LN appears exclusively in this zone, it follows that there must be relationships between the LN and the meso space; it may therefore be suggested that conclusions may be drawn about the limits of the mesosphere from the frequency of LN.

2. Observations

There are LN-observations available for the year 1967 from North America (Fogle [6]), Europe (Paton [7], Schroeder) and the USSR (Willmann [10]). All observations were made by a uniform method. The American data are quite /490 detailed; the British have also been checked; Willmann, on the other hand, only gives a tabular summary.

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[1]Paper prepared for the spring meeting of the "Extraterrestrische Physik" working team in Braunschweig 1970.

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*Numbers in the margin indicate pagination in the foreign text.

We can't give any estimate of the reliability of the observations. Some particularly doubtful subjects could be eliminated from the checked American--British data. The Soviet material is very extensive and characterizes anew the praiseworthy Soviet diligence of observation, on the other hand, however, the summary [10] does not give any final data so that their unambiguity is not assured.

A striking contrast between the American-British observations on one side and the Soviet recordings on the other must be mentioned: The Soviet observers report annually an earlier appearance of LN than is known from the American--European data. This contradiction evidently could be explained by a native expert through analysis of the Soviet data. Also unclear is the degree of inhomogeneity of the recordings, which would be of interest for the statistical evaluation (compare, for example, Dietze [1]). Also the inaccuracies due to psychophysical reasons are largely unknown. Finally, it cannot be established unequivocally on what day of a year an LN was first observed.

3. Mesospheric Circulation and LN

Table 1 contains the LN observations and the last day of reversal for the mesosphere (personal communication of E. Soos). The beginning of the period of frequency of LN is given as the day on which the presence of LN was reported on several consecutive days (nights).

TABLE 1

North America	Europe	USSR	Mesosphere
June 6, 1967[1]	May 31, 1967	June 1, 1967[2]	April

[1]First observations on June 1.
[2]Single observations in March.

It follows from Table 1, that the LN always appears after the completed reversal of the mesosphere to summer conditions. This continuous visibility lasts until the completion of the fall reversal, i.e., until the beginning of the wintry circulation.

No LN can be observed before the beginning of the spring reversal (that is, while the wintry circulation is still on). Sporadic LN have been observed repeatedly during the reversal phase. This may be easily understood when one assume that the reversal from wintry to summer conditions demands a certain time interval. During this time the wheel of circulation may on occasion reach /491 up to 80 km and can contribute to the formation of the LN.

A further indication of the mesospheric circulation may be gained from the appearance of the LN. If one assumes that the LN is related to summery (low!) temperatures in the mesosphere, then its appearance indicates the moment for the reversal from the wintry to the summery circulation. It shows further that the reversal to the summery situation sets in 80 km high later than in the lower altitudes of the atmosphere, that is, it advances from below to above.

The exact opposite relations are found for the fall: the reversal to the wintry circulation advances from the mesosphere to the deeper atmospheric altitudes (compare [8]). This was confirmed recently from the measurements of Theon and Smith [9], in that they emphasize that "the disturbed features characteristic of winter appeared first at high altitudes ---" (p. 162).

4. Conclusion

Even the newer rocket measurements have not been able to explain the problem of the LN, since they could not furnish a convincing proof that the particles registered had any relation to LN. While Farlow and coworkers [2] ascribed the particles of the rocket ascent of July 1, 1968 to the LN, Fechtig and Feuerstein [5] did not reach an unequivocal conclusion.

The interpretation presented here, therefore, offers the possibility of an explanation with regard to the close relations between the mesospheric circulation and the LN, that is for its dependence on the temperature.

Undoubtedly one could object to this interpretation on the basis that it encompasses only a few years. One may further have the concept that the model of Faust [3] representing the rise and fall movements should not be made exclusively responsible for the mesospheric temperature relationships. However, against these arguments one may counter with the statement that the radiation

effects alone cannot explain the extreme temperature differences of the mesosphere between winter and summer.

BIBLIOGRAPHY

1. Dietze, G., "The Temporal and Space Limits of Visibility of Noctilucent Clouds Conditioned by the Vision Performance of the Eye," *Gerl. Beitr. Geophys.*, Vol. 77, pp. 128-140, 1968.
2. Farlow, N. H., G. V. Ferry and M. B. Blanchard, "Examination of Surfaces Exposed to a Noctilucent Cloud," August 1, 1968.
3. Faust, H., "Interaction Between the Different Layers of the Homosphere," *Arch. Meteorol. Geophys. Bioklim.*, Vol. 16, pp. 12-30, 1967.
4. Faust, H., "Results of the Rocket-Projectile Experiments," *Meteorol. Rdsch.*, Vol. 22, pp. 132-134, 1969.
5. Fechtig, H. and M. Feuerstein, "Particle Collection Results from a Rocket Flight on August 1, 1968. MPIH -- 1969 -- Vol. 13.
6. Fogle, B., "Noctilucent Cloud Data for the Period March -- October 1967 from Alaska, Canada, Greenland and Iceland," Toronto, 1968.
7. Paton, J., "Noctilucent Clouds over Western Europe during 1967," *Meteorol. Mag.*, Vol. 97, pp. 174-176, 1968.
8. Schroeder, W., "Srping Transition of Wind of the Mesosphere and Noctilucent Clouds," *Meteorol. Rdsch.*, Vol. 22, pp. 18-19, 1969.
9. Theon, J. S. and W. S. Smith, "The Effects of the Summer to Winter Transition on the Thermal Structure of the Mesosphere," *EOS*, Vol. 50, p. 162, 1969.
10. Willmann, Ch., "Catalogue of Noctilucent Clouds Data during the Period 1965-1967," Moscow, 1969.

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